

Near UV Aerosol Group Report

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NASA GSFC 614

GSFC Aerocenter Update
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People

Research Group:

- Omar Torres (NASA – 614)
- Changwoo Ahn (SSAI)
- Hiren Jethva (GESTAR-USRA)
- Pawan Gupta (GESTAR-USRA)
- Santiago Gasso (GESTAR- Morgan State University)
- Peter Leonard (ADNET)

Collaborations:

- PK Bhartia
- Nick Krotkov
- Mian Chin
- Rich McPeters
- Peter Colarco, Valentina Aquila (JHU)
- E.S. Yang (SSAI)
- Sasha Marshak, Jay Herman (UMBC)
- Kelly Chance (SAO)
- Lorraine Remer (UMBC)
- Robert Loughman (HU)

Projects

OMI near UV aerosol algorithm and products

- Algorithm Upgrades (Ahn, Jethva, Gupta, Torres)
- Product Assessment (Ahn, Jethva, Gasso, Torres)
- OMI-MODIS Synergy (Gasso, Torres)
- Near UV High Spatial resolution (CAI, GLI) Analysis (Gasso, Torres)

Detecting Aerosol Above Clouds (Jethva, Ahn, Torres, Bhartia, Remer)

- OMI
- MODIS Application
- Inter-comparison to other techniques (POLDER, CALIOP)

Ground based observations of aerosols (Krotkov, Mok, Jethva, Loughman, Torres, Labow)

- Combined use of Cimel and UV and VIS MFRS sensors to measure aerosol absorption

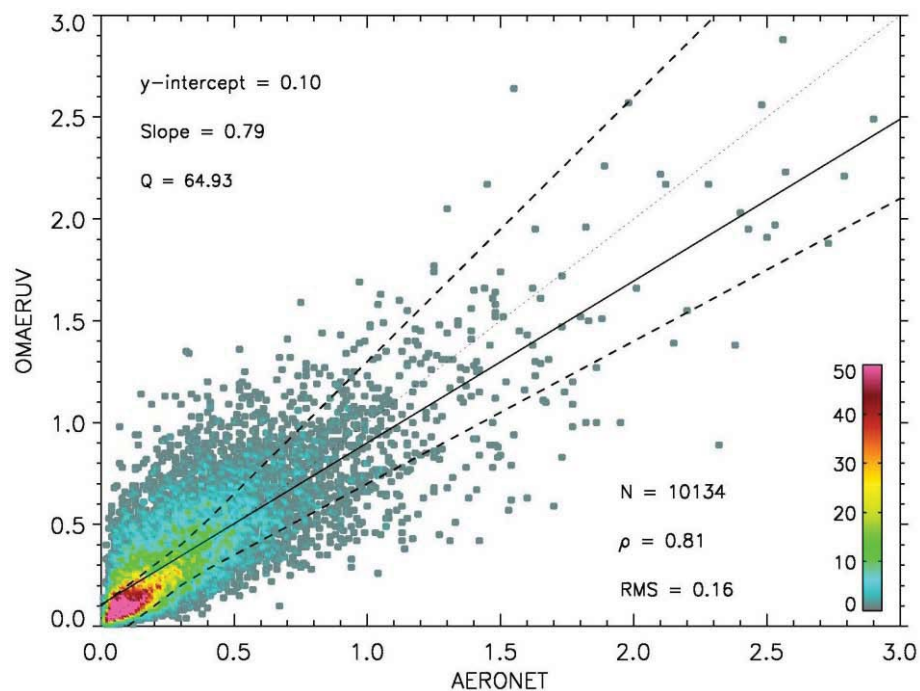
Real and spurious effects of stratospheric aerosols on Satellite-measured total ozone

(Aquila, Yang, Torres, Bhartia, McPeters, Colarco)

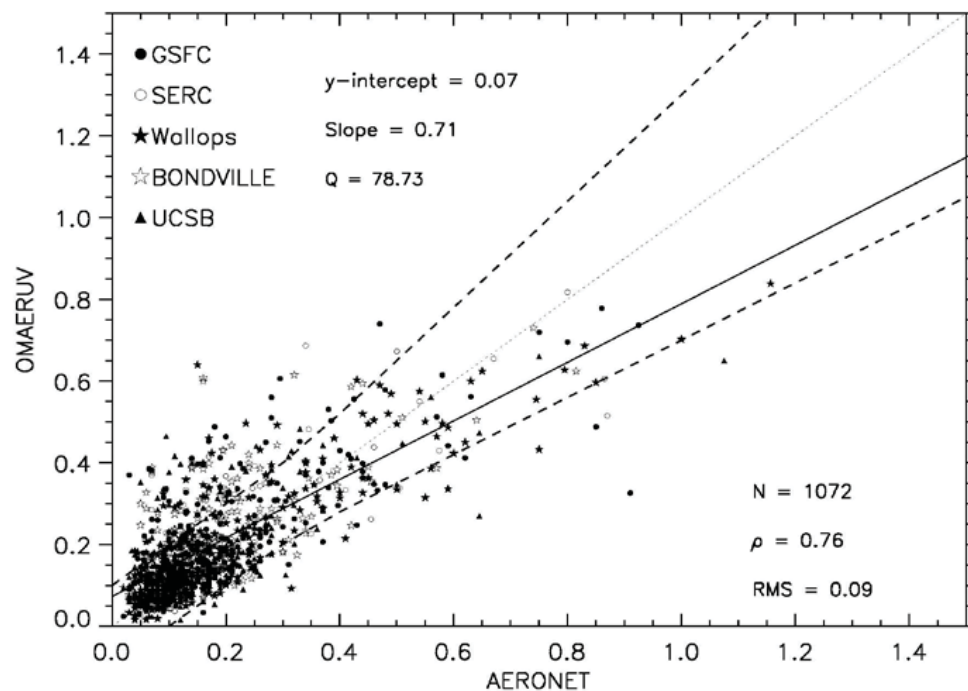
MEASURES Near UV Aerosol Project (Torres, Bhartia)

OMAERUV AOD Validation

Comparisons at 44 AERONET sites over for years (2005-2008)



All sites

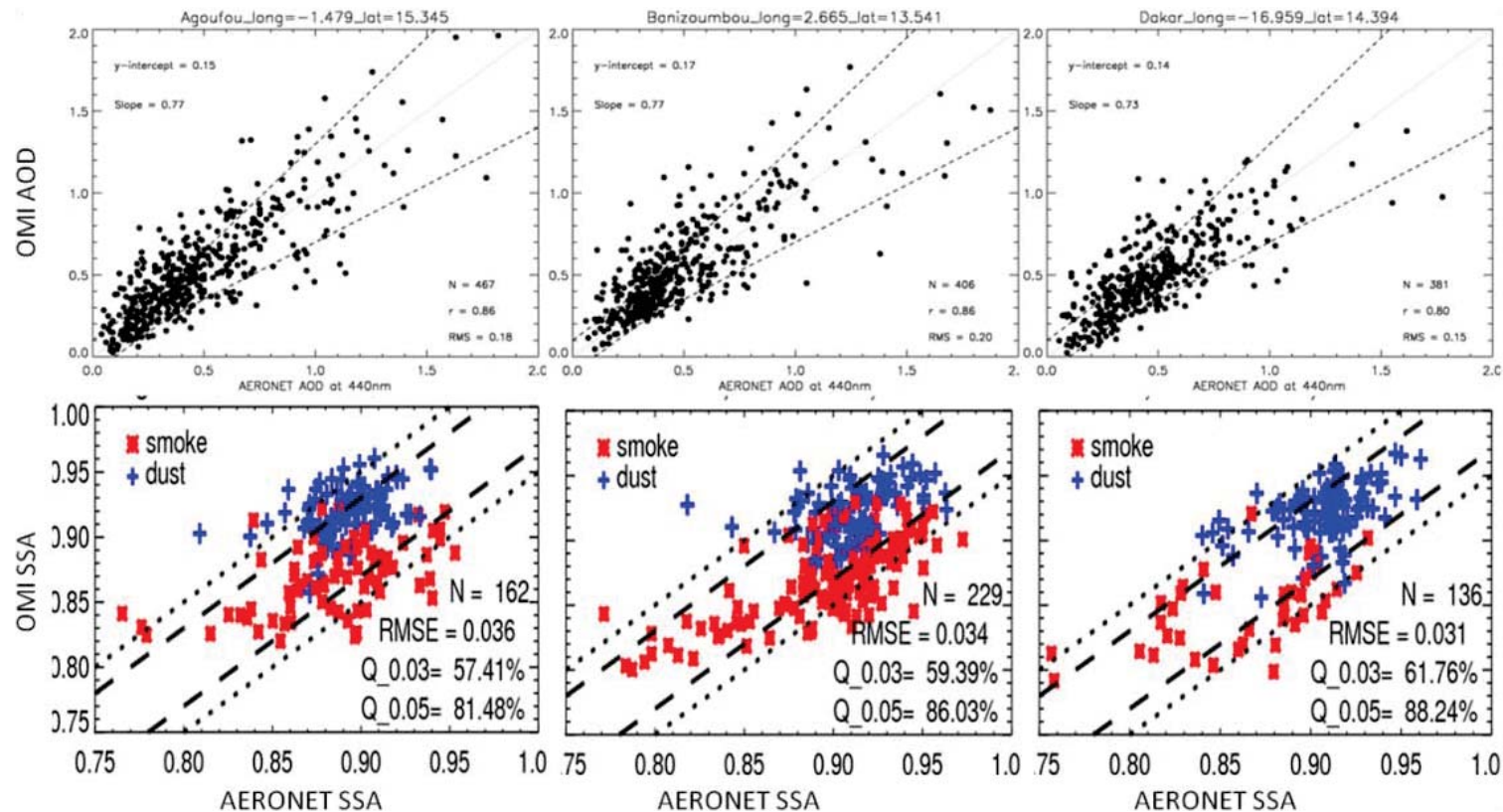


Non-absorbing aerosol sites

Ahn et al., JGR 2013 (submitted); Torres et al., AMT 2013, (submitted)

Single Scattering Albedo Evaluation

Comparison to AERONET SSA (440 nm) retrievals



Most OMAERUV SSA retrievals agree with AERONET's within 0.03 in South America, Northern India, NE China, Eastern Saharan Desert, and the Sahel region.

Larger differences are observed in Central Saharan, Southern Africa and Southeast Asia.

OMI-MODIS AOD analysis

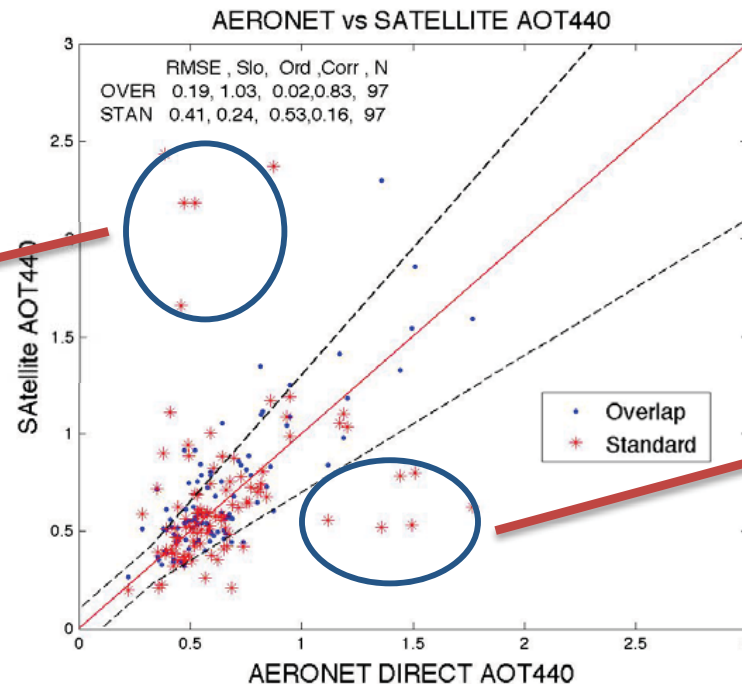
Identification of OMI algorithm and scene specific issues

(Santiago Gassó)

Cloud Contamination



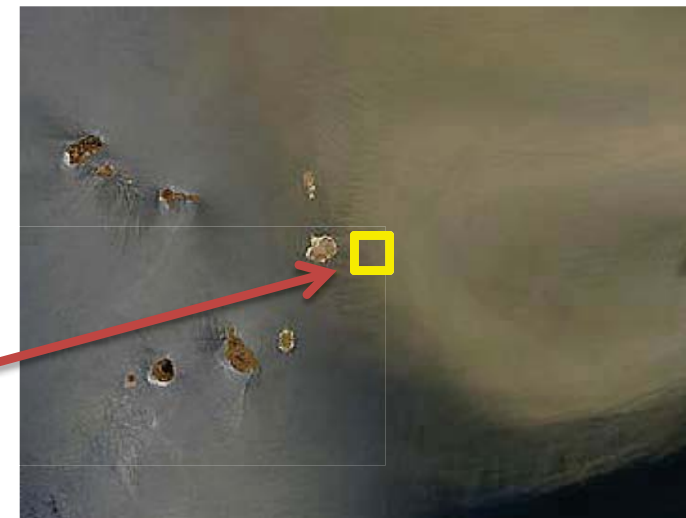
Overestimation of AOD
in partly cloud
conditions



About the graphs:
Collocated OMI+MODIS+Aeronet pixel (years 04-11)

Overlap : OMI AOD corrected by the MODIS AOD
Standard : OMAERUV AOD

Algorithm Related issues

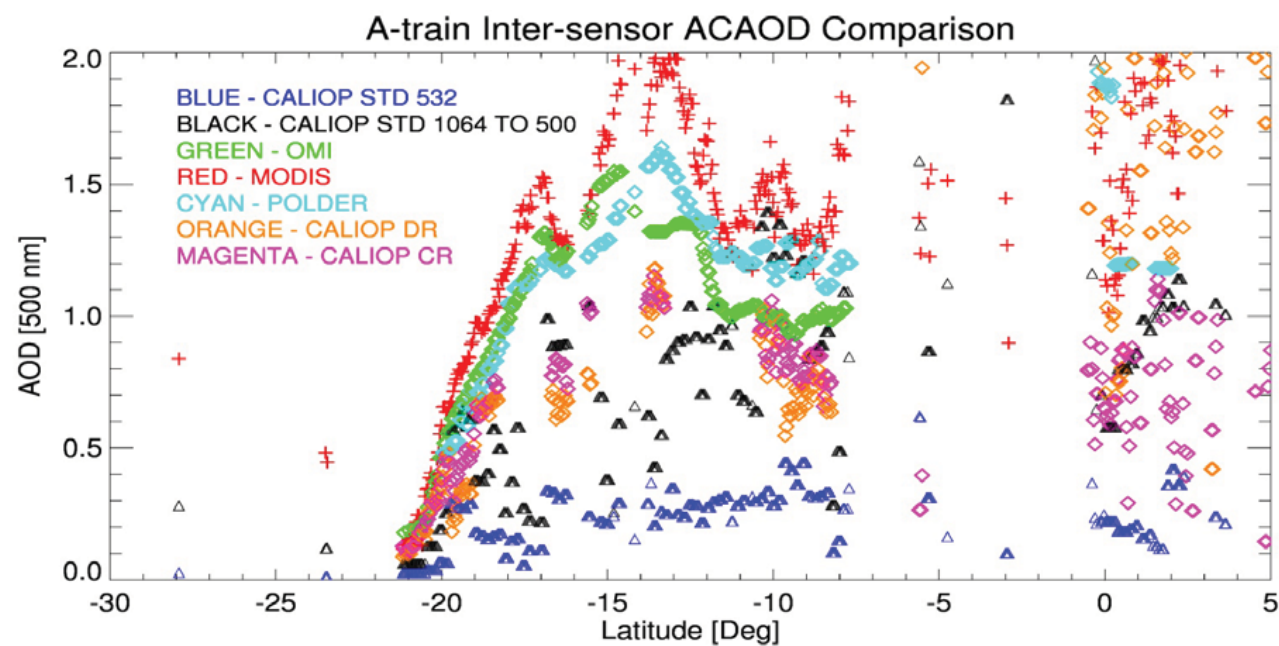
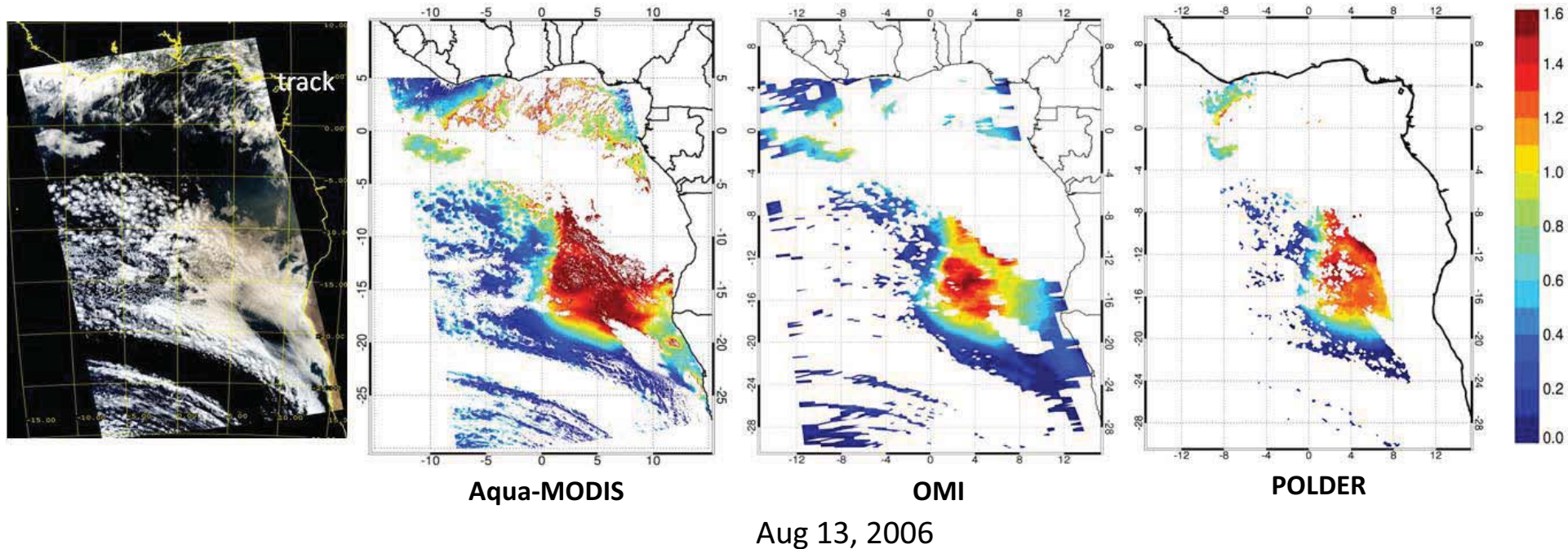


Underestimation of AOD in
very dense dust storms
(assumed size distribution,
aerosol height)

Gasso and Torres (in preparation)

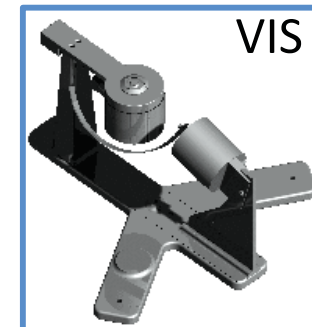
Aerosols Above Clouds: Sensor Inter-comparison

(Jethva, Torres, Waquet, Chand)



Combined use of CIMEL and Modified UV and VIS MFSR Measurements

(Krotkov, Torres, Mok, Labow, Jethva, Loughman)



Inter-calibration:

$$\tau_{440}^{Cimel} = \tau_{440}^{MFSR}$$

Direct Sun measurements: AOD
Sky-radiance measurements

Replace three original UV filters with CIMEL's 340, 380 and 440 nm filters.

Add a 440 nm CIMEL filter to VIS MFSR sensor

Measure 1 min F_{diff} and F_{tot} (3% error)

Calculate F_{dir}

Derive τ_{uv-vis}^{MFSR}

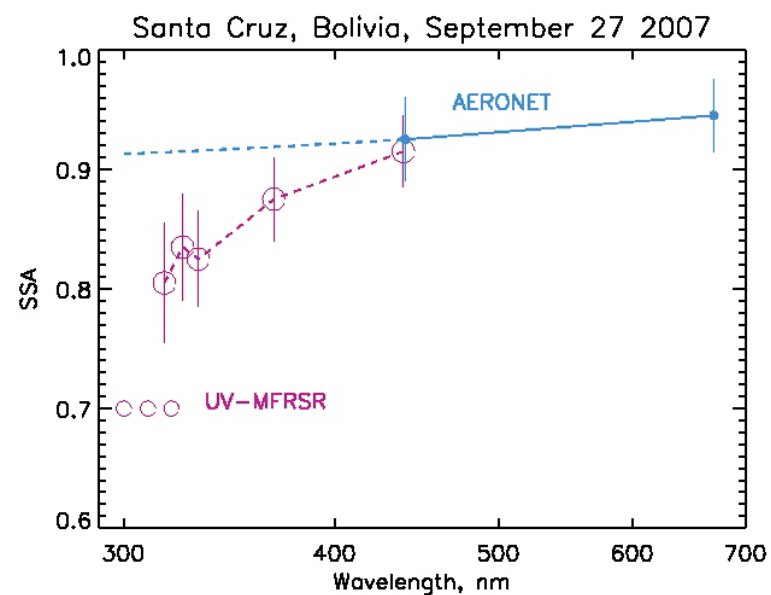
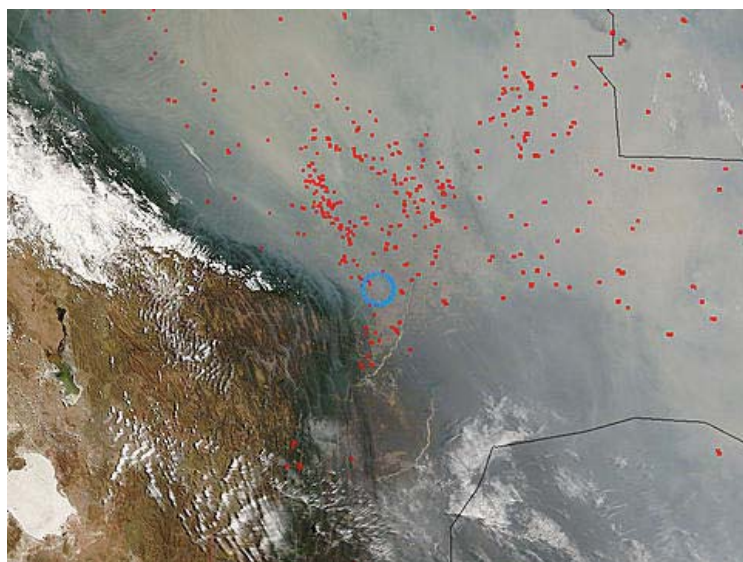
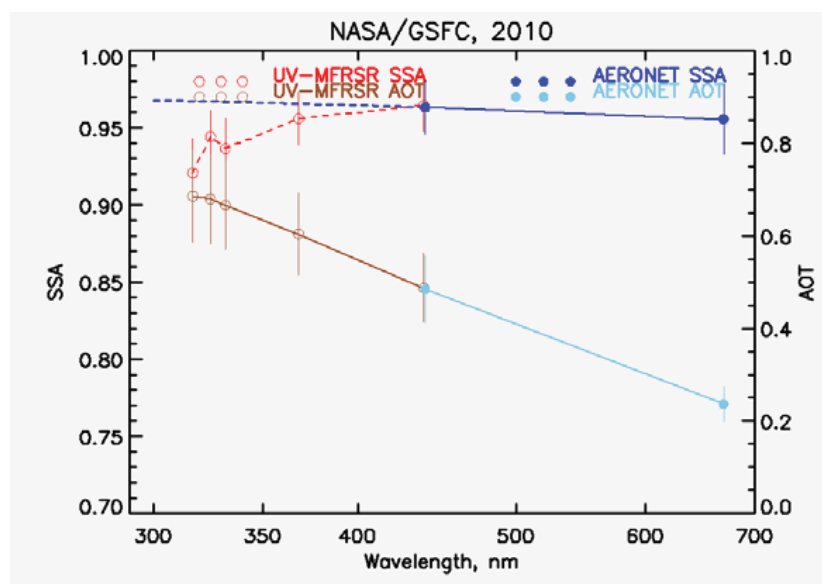
Particle Size Distribution
Real Refractive Index

$$\tau_{uv-vis}^{MFSR}$$

Mie plus RT Calculations

K_{uv-vis} SSA_{uv-vis} that explains measured
 F_{diff}/F_{tot} ratios

CIMEL and Modified UV and VIS MFSR observations: Results

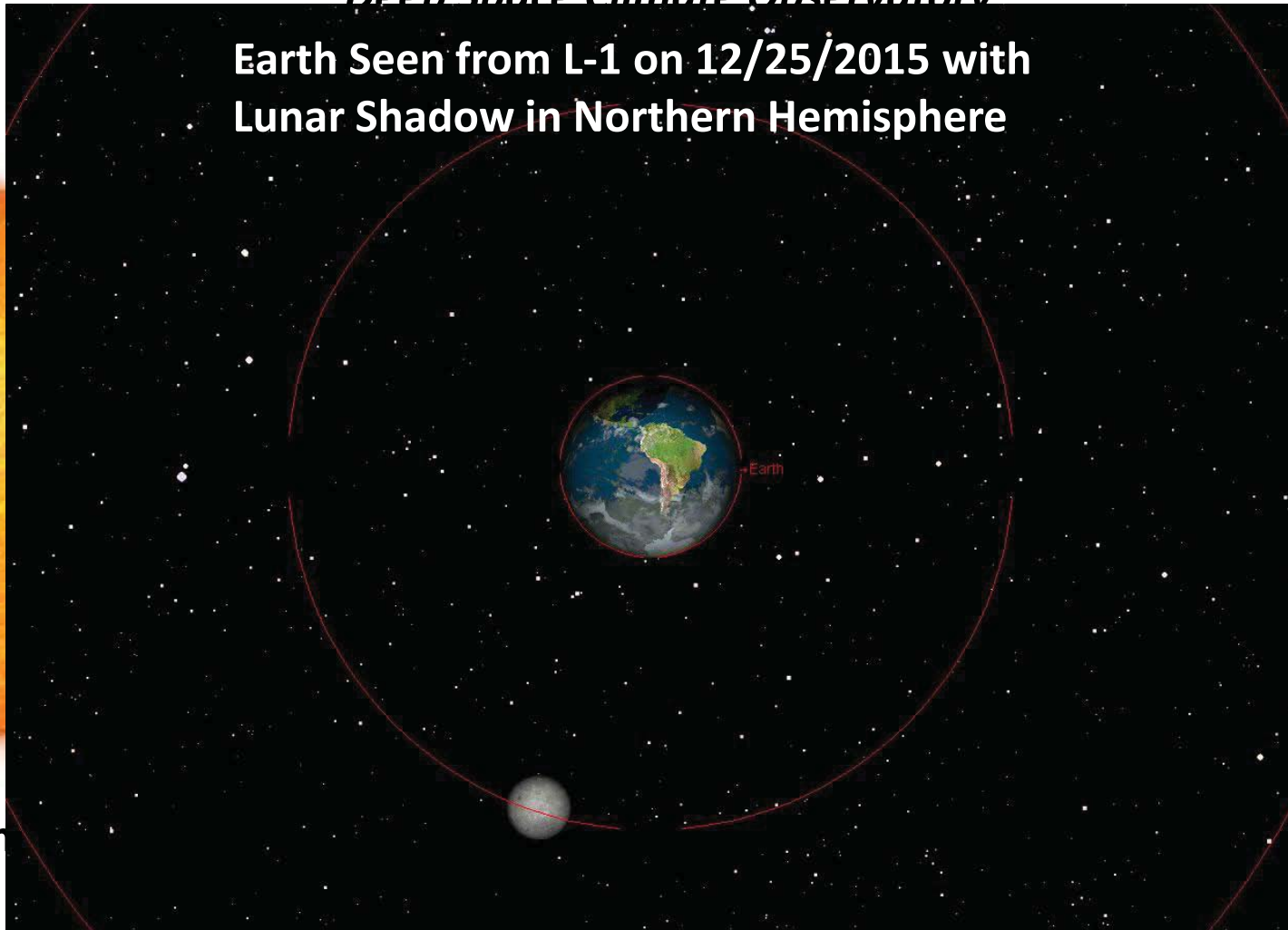


Plan to return to Bolivia in 2013 using three-instrument suite

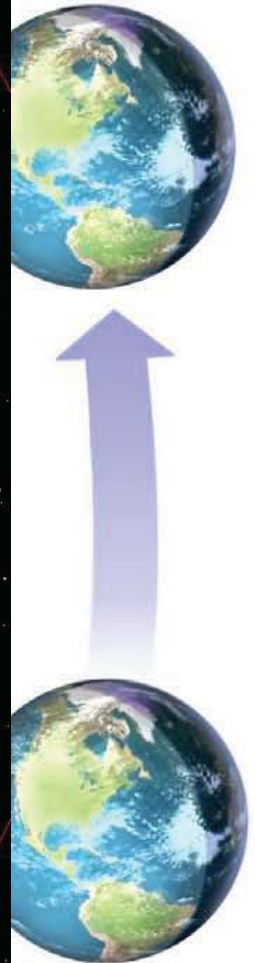
Future Perspective:
DSCOVR At Lagrange-1

Deep Space Climate Observatory

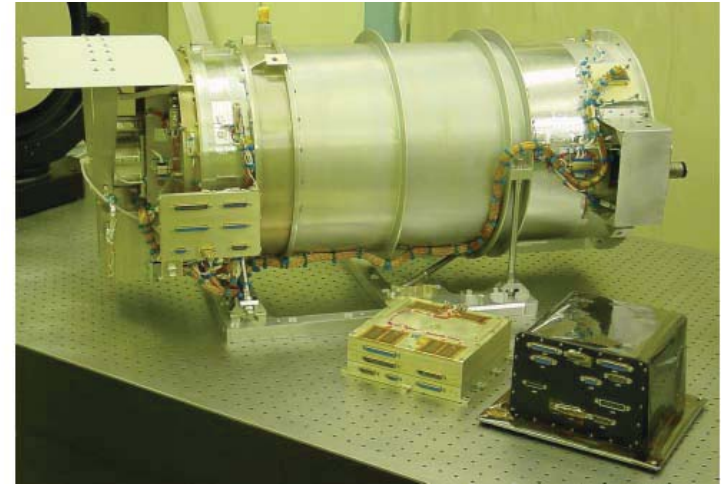
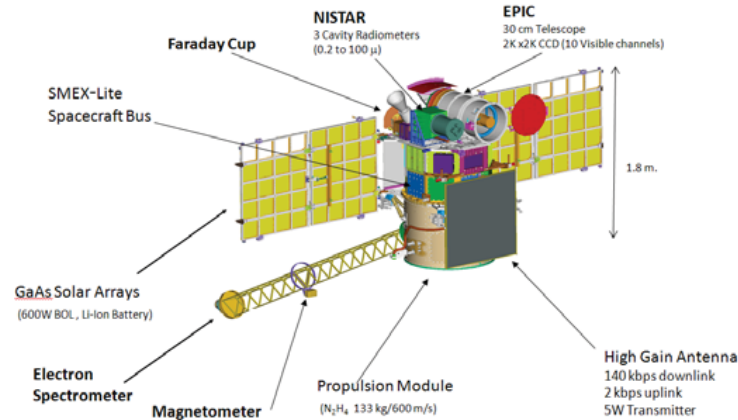
**Earth Seen from L-1 on 12/25/2015 with
Lunar Shadow in Northern Hemisphere**



**At L1, the
and the
position relative to the Earth and Sun**



DSCOVR Observatory Operational Configuration



Earth Polychromatic Imaging Camera

Channels and Applications

Channel (nm)	FWHM (nm)	Purpose	Spatial Resolution (km)	SNR	Exp. Time (seconds)
317.5 ± 0.1	1 ± 0.2	Ozone, SO ₂ , UV	10*	265	1.3
325 ± 0.1	1 ± 0.2	Ozone, UV	10	265	0.84
340 ± 0.3	3 ± 0.6	Ozone, Aerosols, UV, and Volcanic Ash	10	265	0.13
388 ± 0.3	3 ± 0.6	Aerosols, Clouds, UV and Volcanic Ash	10	266	0.087
443 ± 1	3 ± 0.6	Blue, Aerosols, Vegetation	10	265	0.052
551 ± 1	3 ± 0.6	Green, Aerosols, Vegetation	10	265	0.030
680 ± 0.2	2 ± 0.4	Red, Aerosol, Veg., O ₂ B-Band, Clouds	10	266	0.037
687.75 ± 0.2	0.8 ± 0.2	O ₂ B-Band Cloud Height	10	266	0.060
764.0 ± 0.2	1 ± 0.2	A-Band Cloud Height	10	265	0.061
779.5 ± 0.3	2 ± 0.4	A-Band Reference, Vegetation	10	265	0.036

Official launch date: November 2014

Science Team to be selected via ROSES call

Future Perspective (2):

Tropospheric Emissions: Monitoring of Pollution (TEMPO)

PI: Kelly Chance (Smithsonian Astrophysical Observatory)

- First GEO NASA Science Mission
- Commercial Satellite Hosted Payload
- GEOCAPE Precursor
- To be launched in 2019

GEOGRAPHICAL COVERAGE



KEY INSTRUMENT CHARACTERISTICS

Requirements		Comment
Field of Regard	GNA	Mexico City to Canada tar sands & Atlantic to Pacific
Imaging Time	1 hr	1250 scan positions with 2.8 sec integration
Footprint N/S	2.0 km	Native pixel achieved by 44 cm telescope effective focal length
Footprint E/W	4.5 km	
Spectral Range	290-690 nm	1,024 spectral channels matched to 2k focal plane
Spectral Resolution	0.6 nm	Achieved by spectrometer design
Spectral Sampling	0.2 nm	

PLANED PRODUCTS

Species	λ Band nm	SNR Reqs	SNR Predict	EOL Margin
SO ₂	305-345	1297	1820	40%
H ₂ CO	327-354	487	2094	330%
NO ₂	423-451	1233	1910	55%
C ₂ H ₂ O ₂	433-457	1350	2331	73%
O ₃ (UV)	303-345	1122	1635	46%
O ₃ (Vis)	546-648	958	1254	31%
AOD	354, 388	1000	1596	60%

SCIENCE TEAM

Kelly Chance, (PI)	SAO	Xiong Liu, (DPI)	SAO
James Carr	Carr Astro	Ronald Cohen	UC Berkeley
David Edwards	NCAR	Jack Fishman	St. Louis U.
David Flittner	LaRC	Jay Herman	UMBC
Daniel Jacob	Harvard	Scott Janz	GSFC
Joanna Joiner	GSFC	Nickolay Krotkov	GSFC
James Leitch	Ball	Randall Martin	SAO
Doreen Neil	LaRC	Michael Newchurch	UAH
R. Bradley Pierce	NOAA	Robert Spurr	RT Solutions
Raid Suleiman	SAO	James Szykman	EPA
Omar Torres	GSFC	Jun Wang	U. Nebraska